Prevention of Rh(D) alloimmunization: a cost-benefit analysis

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The Rh Programme of Nova Scotia was established in 1964 for the prevention and treatment of Rh(D) alloimmunization. The program's effectiveness in preventing the condition has been established previously. Because of increasing budget restraint in health care we decided to examine the cost-effectiveness of the program by comparing the cost of prevention (office administration fees, program staff salaries and the price of Rh immune globulin) with the cost of health care services required in addition to standard obstetric procedures and neonatal care in 80 cases of Rh(D) alloimmunization treated from 1982 to 1986. Neonatal intensive care accounted for 80.1% of the additional health care expenses; an extra 512 hospital days for such care constituted 65.7% of the total treatment expense. The cost per case prevented ($1495) was 2.7 times less than the cost per case treated ($3986).

En 1964 on fondait en Nouvelle-Ecosse le "Rh Programme" pour la prévention et le traitement de l'allo-immunisation Rh(D). Son efficacité préventive est déjà prouvée; c'est sa rentabilité qu'il faut maintenant établir, vu la compression croissante du budget de la santé. Nous comparons donc le coût de la prévention (administration, salaires, immunoglobuline anti-Rh) à celui du traitement, soit les dépenses encourues, en sus des soins obstétricaux et néonatals habituels, pour le traitement dans 80 cas d'allo-immunisation Rh(D) de 1982 à 1986. De ces dépenses 80,1% représentent les soins intensifs en pouponnière; les 512 journées supplémentaires d'hospitalisation entraînent 65,7% des dépenses globales. Le coût par cas prévenu (1495 $) est 2,7 fois moindre que le coût par enfant traité (3986 $).

The prevention of Rh(D) alloimmunization and complications of erythroblastosis fetalis is one of the major successes of preventive medicine in the past 20 years. In theory the administration of Rh immune globulin to susceptible pregnant women should prevent more than 95% of cases of alloimmunization.[1] In practice we have shown that 88% of expected cases were prevented through the Rh Programme of Nova Scotia.[2] In a time of increasing health care budget restraint the cost-effectiveness of such a program may also have to be determined. Thus, we assessed the cost of the program and of the treatment of cases of Rh(D) alloimmunization in Nova Scotia.

Methods

Since its inception in 1964 the Rh Programme of Nova Scotia has been funded by the Nova Scotia Department of Health and endorsed by the Medical

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Society of Nova Scotia. All blood group and antibody data for pregnant patients in Nova Scotia are reported to the program.

From 1982 to 1986 Rh immune globulin was administered to all Rh-negative unimmunized women after abortion, ectopic pregnancy and amniocentesis, at 28 weeks' gestation and within 72 hours after delivery of an Rh-positive infant. We reviewed all cases of Rh(D) alloimmunization in pregnancy occurring in Nova Scotia in the same period. In each case the cost of normal obstetric care was excluded, but the cost, determined from the provincial fee schedule, of all additional medical procedures and hospital days incurred because of complications due to Rh(D) alloimmunization was noted. The expenses were balanced against administration costs (related to the Rh program office, nurse and secretary) and the price of the Rh immune globulin. All amounts were based on 1986 prices.

Results

From 1982 to 1986 there were 80 pregnant women with Rh(D) alloimmunization. The costs of additional health care services are shown in Table 1. The cost of medical procedures included physicians' procedural and hospital visiting fees. Hospital days were extra days incurred because of investigation and treatment (e.g., intrauterine fetal transfusion), method of delivery (cesarean section) or the need for neonatal intensive care.

During the study period there were 62 788 births in the province. Without prevention the rate of Rh(D) alloimmunization would be 10 per 1000 total births;[3,4] thus, 628 cases were expected to occur in Nova Scotia. In practical terms our program prevented 548 (87%) of the expected cases and reduced the Rh(D) alloimmunization rate to 1.3 per 1000 total births. There were three perinatal deaths from Rh(D) alloimmunization.

A total of 18 337 doses of Rh immune globulin were given. This figure was known because all doses for the province are supplied by one central office.

The cost per case prevented ($1495) was 2.7 times less than the cost per case treated ($3986) (Table 2).

Table 1: Costs of health care required in addition to standard obstetric care in 80 cases of Rh(D) alloimmunization from 1982 to 1986

Additional health care	No. of patients	Medical procedures*		Hospital days†		Total cost, $
		No.	Cost, $	No.	Cost, $	
Amniocentesis	33	210	11 377	–	–	11 377
Intrauterine fetal transfusion	5	12	2 685	36	14 724	17 409
Antepartum care	9	21	489	21	8 589	9 078
Cesarean section	15	15	2 390	30	12 270	14 660
Neonatal intensive care	32	332	46 125	512	209 408	255 533
Laboratory investigation and ultrasound	80	–	–	–	–	10 809
Total cost, $						318 866
Cost per case treated, $						3 986

*Constitutes physicians' fees for performing procedures and visiting patients in hospital.
†Extra days incurred because of additional health care.

Table 2: Comparison of the costs of prevention and treatment of Rh(D) alloimmunization based on the number of births and of expected and prevented cases in Nova Scotia, 1982–86

Prevention	Cost, $	Treatment	Cost, $
Rh Programme of Nova Scotia (annual budget of $53 800 × 5 yr)	269 000	Additional health care per case (as outlined in Table 1)	3 986
Rh immune globulin ($30 per dose × 18 337 doses given)	550 110	Expected cases without prevention (628 × $3 986)	2 503 208
Total	819 110	Total	2 503 208
Cost per case prevented	1 495	Cost per case treated	3 986

Discussion

Arguments over theoretical cost-effectiveness have swung in favour of both antenatal and postnatal prevention of Rh(D) alloimmunization through the administration of immune globulin to susceptible unimmunized pregnant women.[1,4-7] The cost-effectiveness of postnatal prevention was never in doubt, but the acceptance of antenatal prophylaxis has been slower. Bowman[1] has shown that although antenatal prevention is 11 times more expensive than postnatal prophylaxis it is still cost-effective at a cost of $35 per dose of Rh immune globulin. His estimate was $3300 per case prevented through antenatal prophylaxis.

If used alone postnatal prophylaxis has an effectiveness rate of about 85% to 90%. Of the cases of alloimmunization about one-third occur during the first pregnancy, one-third are caused by failure to give anti-D immune globulin, and the rest are due to transfusion or failure of the immune globulin to prevent immunization.[8] In 1987 Clarke, Whitfield and Mollison[7] reported deaths from Rh hemolytic disease in England and Wales from 1977 to 1985. They found that in 13.2% of all deaths the women had become immunized during their first pregnancy. By 1984–85 the proportion had risen to 20.7%. In our study alloimmunization developed during pregnancy in 17 (21%) of the 80 women, and it was caused by failure to give Rh immune globulin in 40 (50%) of the cases. Thus, if antenatal prophylaxis is omitted 1.5% to 2.0% of all susceptible pregnant women will have Rh(D) alloimmunization with sequelae as serious as those in cases of postpartum alloimmunization.[1]

In our review 80.1% of the additional health care expenses were incurred because of the need for neonatal intensive care. The cost of the extra 512 hospital days needed for such care alone was 65.7% of the total cost. Even this estimate is understated since we had to apply the 1986 price of an average hospital-bed day to the neonatal unit because the provincial fee schedule gave no specific daily cost for neonatal intensive care. In addition, we ascribed the entire budget of the Rh program to the cost of prevention, even though about 20% of that budget is allocated to treatment. Thus, the true cost of treatment is considerably more than we have calculated. An additional hidden expense of treatment is the indirect nonmedical costs incurred by the patient.

In summary, we have found that an Rh(D) alloimmunization prevention program is cost-effective.

The data collection and analysis were funded in part by a grant from the H.B. Atlee Endowment Fund.

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